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Figs. 11-14. Surface views of epidermis of *Tradescantia discolor*, from first appearance of stomata to maturity of the same.

Fig. 15. Cross section of about the age of No. 12, *b*.

Fig. 16. Cross section of the age of No. 13.

Fig. 17. Cross section of full-grown.

Fig. 18. Longitudinal section of the same.

× 400. The arrows indicate the direction of the point of the leaf.



## AQUEOUS PHENOMENA OF THE PRAIRIES.

BY PROF. H. W. PARKER.



THE igneous scenes of the prairies have become very common place in description. But where is there any account, either scientific or popular, of the interesting aqueous phenomena, in winter and in summer?

How it may be in the region protected on the north by the Lake Superior highlands and affected by the air of the lakes, the writer does not know, except that the temperature is much modified. But in central Iowa intense cold is of frequent occurrence, and there are conditions along with it that often bring out the splendors and wonders which we associate with arctic scenes. Parhelia, or mock suns, at morning or evening, are common; without exaggeration it may be said that they equal the real sun in brilliancy, and are indeed blinding to the sight. After witnessing them, an eastern man regards all that he has seen of this phenomenon at the east as insignificant. So likewise, mock moons, and both lunar and solar halos, crosses, and far-extending complicated circles of light, with bright spots at the intersections, may be mentioned as sights by no means unusual, and often of great magnificence and duration, continuing a good part of the day or night. The writer remembers, for example, a circle passing through the sun and reaching horizontally quite around the sky, making part of a cross inscribed within another circle around the sun, there being also four tangent circles at the ends of the cross; and this was visible for several hours before and after midday. The cloudless sky of the West conspires with spicules of frozen vapor, to render these effects not rare; for the West, at least beyond the vicinity of the lakes, is bright and sunny at all seasons.

Feathery crystals, frequently of great size and beauty, and completely clothing every exposed object, are sometimes to be seen

for a succession of mornings and would number many repetitions in the course of every winter. The writer counted a dozen fine exhibitions of this kind before one winter was half gone. In cold weather, a perceptible thin vapor comes on at night, not uncommonly, when the air has a stillness favorable to the growth of this icy leafage. In certain covered situations, where moisture rises, cobwebs are changed to a lace-work of crystals, the length and delicacy of which would be incredible to one who never lived in such a climate. In a cellar stair way, the plastering and shelf and every article on it were soon robed with a polar-bear fur of icy filaments, so long that the smaller articles lost their identity of shape.

It is well known that the fine porous soil of the West has a marvellous ability to support vegetation, during the long droughts that characterize the region. The cracking of the earth in a prolonged drought is wonderful, especially along the beaten surface of roads. Fissures over an inch across have been measured. How the subsoil can retain any moisture, with such openings down into its heart, is a mystery. On the high treeless rolling prairie, however, at the summit level between river systems, water is readily obtained at a depth of from fifteen to twenty feet, though not always in sufficient quantity. The manner in which wells are made for the supply of mills, in such a situation, is worthy of publication. A shaft is sunk, say thirty feet, and from the bottom galleries are drifted in various directions, in the style of a mine, sometimes to the length of a hundred feet. Thus, numerous very small veins are struck, which, all together, give a large supply of water. The workmen report these veins as occurring at somewhat regular intervals, and as indicated by a root-like mass of darker earth; it is affirmed, too, that they follow one general direction,—in one instance at least, said to be transverse to the surface drainage.

In this connection, reference may be made to the subterranean cryptogams that penetrate almost every inch of the deep, loamy gray clay beneath the top soil in that prairie region, and perhaps in all similar districts. This vegetation, threadlike or coarse stringlike, is coated with dark discolored earth, and is mostly dead, the thread lying shrivelled, black and loose in its cylindrical cavity; but the writer has found the filaments apparently fresh and living at a great depth—even to the depth of eight feet, if his memory is not at fault.

One very common peculiarity of the surface drainage may be

noticed—the extent to which the water of the sloughs, or swales, reaches up the acclivities on either hand, even where the interval has a very considerable descent in the line of flow; there is thus a broad concave bog that must strike a stranger with surprise, for it is not due to springs, but rather to a spongy retention of rainfall.

Some peculiarities of prairie storms should not be omitted in this sketch. Nothing at the West is done by halves; when it rains, *it rains*; and the general surface is so uniform, the soil to a certain depth so pervious, that something like a subterranean lake is suddenly formed, which rapidly rises, flooding cellars and even bursting up the cement of cellar floors by hydrostatic pressure, if cement has been resorted to, by the trustful immigrant.

One species of prairie storm should be elevated to the rank of a genus. It is mostly nocturnal in its habits and prowls all night; its distinguishing characters are surges of rain, rhythmic roar of wind like that of heavy billows on a coast, incessant quiver of lightning, and overlapping continuous peals of thunder. It is as if the spirits of the old American Mediterranean sea were claiming again their last battle-ground—a suggestion harmonizing with the ocean-like level of the country and the looming mirages of sunny days. But the lightning of this species of storm seems to be among the clouds, and the new-comer soon becomes fearless; indeed, it does not require a long residence at the West to make one familiar with lightning, however timid he may have been at the East, although it remains true that thunder gusts are not pleasant to a person who is out on the open prairie, where man or horse is the only prominent object to attract the downward or upward bolts of electricity. Finally there is something peculiarly grand in western thunder. No hills break its smooth roll, and its long crescendos and diminuendos give a breath and cadence to the sound, as if chariots could be heard rolling on for hundreds of miles over the level prairie floors.

The subjects of this article have not been in the path of the writer's special study; but he believes that the prairie region offers a fresh and interesting field of observation in this regard. The reports and books where the information might properly be looked for, have failed to give him any information in respect to the relative humidity of the prairie atmosphere—a matter of prime importance. On average winter days, the writer found it from forty to fifty hundredths of saturation.